

Requirements for the Radiation Safety

2001/5/30 version	Limit (factor 2 lower than law)
Boarder to the outside	< 50 micro Sv / year
Normal Area	< 0.25 micro Sv / hour ← JHFNu
General Controlled Area	< 1.5 micro Sv / hour ← K2K
Soil	< 11 mili Sv / h (point) (was 22 for K2K) < 5 mili Sv / h (line) ~10 microSv / yr water ~3.7Bq/g

Design

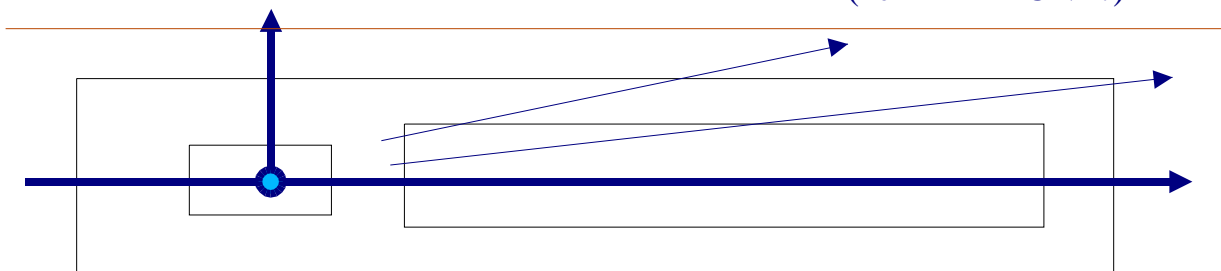
$$3.3 \cdot 10^{14} \text{ppp} \cdot 0.292 \text{Hz}$$

	lim.at ground	Energy	PPS	(POT)
K2K	<1.5	50(12)GeV	$3.0 \cdot 10^{12}$	$(2 \cdot 10^{20})$
JHFNu	<0.25	50GeV	$9.6 \cdot 10^{13}$	-
Factor	6	1	30	

Method

Moyer's formula

MARS simulation
(+JAERI MCNP?)



$$\propto \exp(-\sum l_i) / r^2$$

$l_i = d_i / \lambda_i$ M.F.P.

$$1/6 = \exp(-l_g)$$

$l_g = 1.8$

== + 1.6m soil

$$1/30 = \exp(-l_s)$$

$l_s = 3.4$

== + 0.9m Fe
+ 2.1m concrete

+ 1.6m heavy concr.

	Dens	thick	att.len
$d_i =$	ρ_i	$* t_i$	$, \lambda_i \rightarrow l_i$
Soil	1.6g/cm ³	(1m),	139g/cm ² → 1.15
Fe	7.2g/cm ³	(1m),	188g/cm ² → 3.83
Concr.	2.3g/cm ³	(1m),	143g/cm ² → 1.61
HeavyC.	3.5g/cm ³	(1m),	163g/cm ² → 2.15

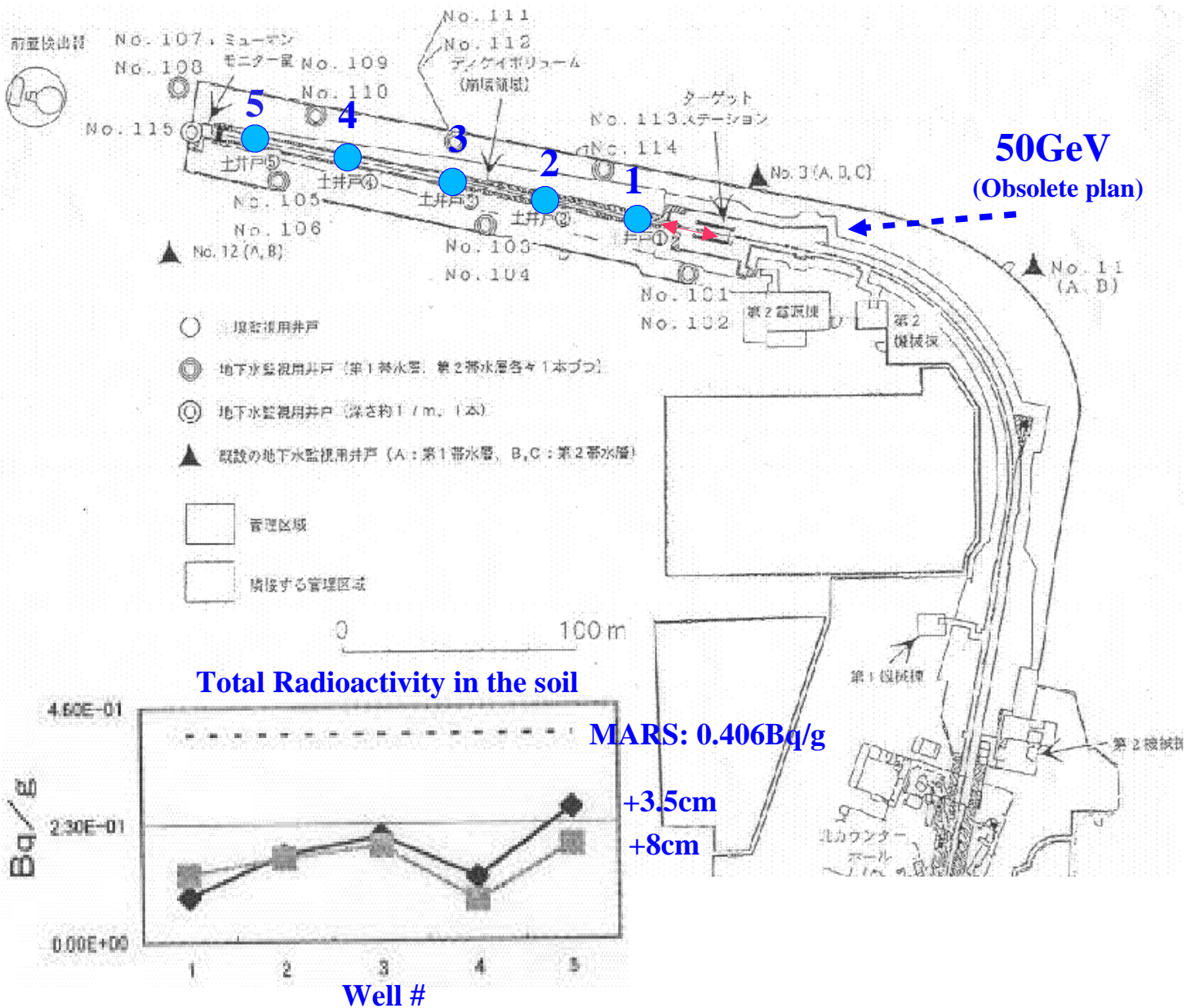
For 4MW: ln(4) = +1.4 for l_s : (+0.9m concrete)

MARS simulation & Reality (K2K)

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	Exposure	MARS	Measuramant
Soil in Well	5/11-6/21'00	0.41 Bq/ g	0.26 Bq/g
(Decay Vol)	6.8e18pot	1.2mSv/h	↔ 0.77mSv/h
Ground level	5/29 2001		
Survey(TGS)	4.6e19pot(Apr26)	-	<=0.27microsv/h

Data/MC : factor 1/2 (well agreed)



TGS (quick estim.) Soil (K2K) + 1.5m
 Concrete(normal) (K2K) + 2m (+1m for 4MW)
 Decay Volume MARS ~ reality